U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

RIC 2016

MELCOR Applications and Development

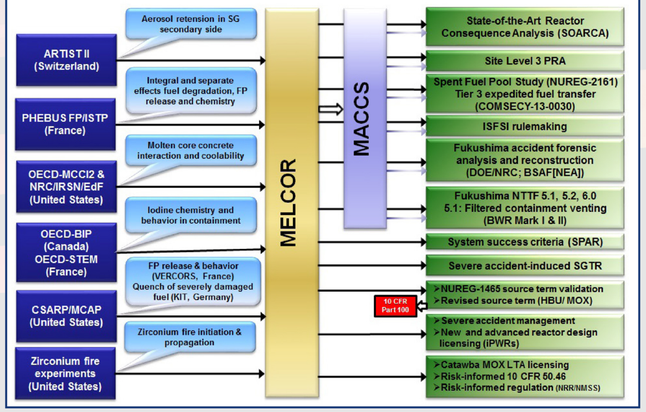
Severe accident research activities

- Support Risk-Informing Regulations and Address Operating Reactor Issues
  - Retain experts who have severe accident phenomenological knowledge and maintain validated analytical tools
- International Collaboration
  - U.S. NRC Cooperative Severe Accident Research Program (CSARP)
  - Annual MELCOR Meetings
    - MELCOR Code Assessment Program (MCAP) - (Fall 2016 in the United States)
    - European MELCOR User Group (EMUG) – (Spring 2016 in London)
    - Asian MELCOR User Group (AMUG) – (held October 2015 in Japan)
  - NEA/CSNI and European Commission

MELCOR development

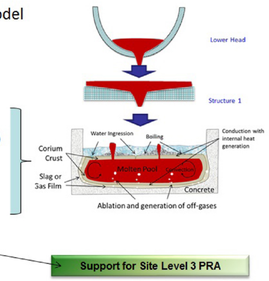
- Design Objectives
  - Model severe accidents and provide reasonable prediction of accident progression, source term, and uncertainty.
  - Model containment thermal-hydraulic phenomena for design-basis analysis (DBA).
  - Properly scale phenomena important to DBA and severe accidents from separate effect tests and integral effect tests to full size reactors.
  - Develop models consistent with lumped parameter code framework (simplified vs. complex).
- Targeted Applications
  - Perform plant-specific integrated analysis under postulated beyond DBA events and application to probabilistic risk assessment (PRA).
  - Perform containment response analysis under postulated DBA and beyond-DBA events.
  - Perform accident analysis of nonreactor systems (e.g., spent fuel pool).
- Success Criteria
  - Prediction of phenomena in qualitative agreement with current understanding of physics and uncertainties are in quantitative agreement with experiments.
  - Focus on mechanistic models where feasible with adequate flexibility for parametric models.
  - Code is portable, robust, and relatively fast running, and the code maintenance follows established software quality assurance standards.
  - Ensure availability of detailed code documentation (including user guide, model reference, and assessment).

Code development and regulatory applications



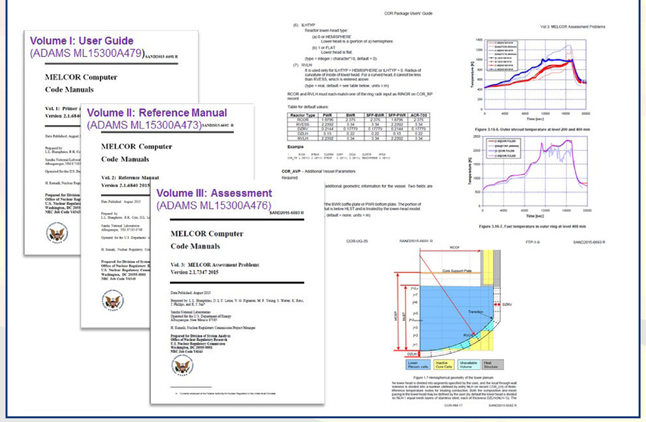
Modeling improvements and new models

- Homologous pump model
- Multi-heat structure radiation enclosure model
- Aerosol re-suspension model
- Zukauskas heat transfer coefficient
- Simplified bubble swell model
- Debris spreading model implemented
- Core catcher (multiple containment vessels)
- New debris cooling models added
  - Water-ingression
  - Melt eruption through crust
- MACCS multi-ring release
- Multiple fuel rod types in a core cell

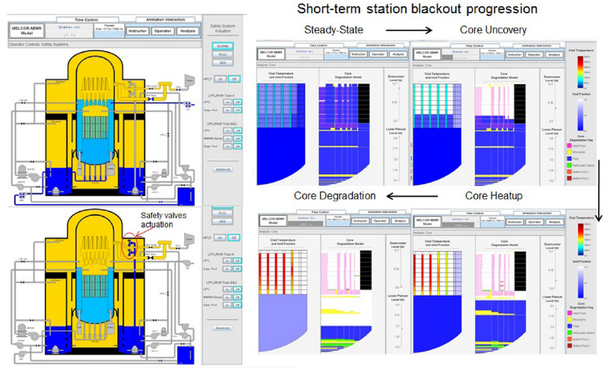


Support for Site Level 3 PRA

MELCOR documentation



MELCOR visualization



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